Paper No. 3

ENZYMATIC OXIDATION OF INDOLE-3-ACETIC ACID, A PLANT GROWTH HORMONE, IN TOBACCO AND ITS POSSIBLE APPLICATION TO THE SUCKER CONTROL PROBLEM.

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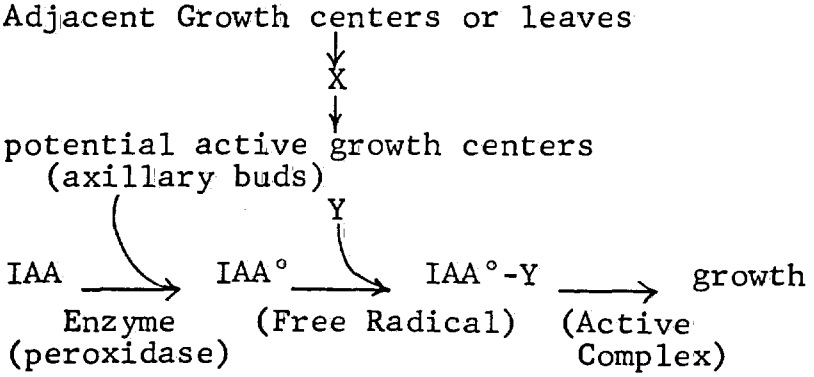
ABSTRACT

This study of the metabolism of Indole-3-Acetic Acid (IAA) emphasizes its enzymatic oxidation by peroxidase enzymes. In accordance with a new concept of IAA action, the enzymatic oxidation of IAA in plants is considered an essential step in its action in promoting growth or cell-elongation in plants. Experimental evidence leads to the following formulation of the process of IAA transformation as it may occur in plants:



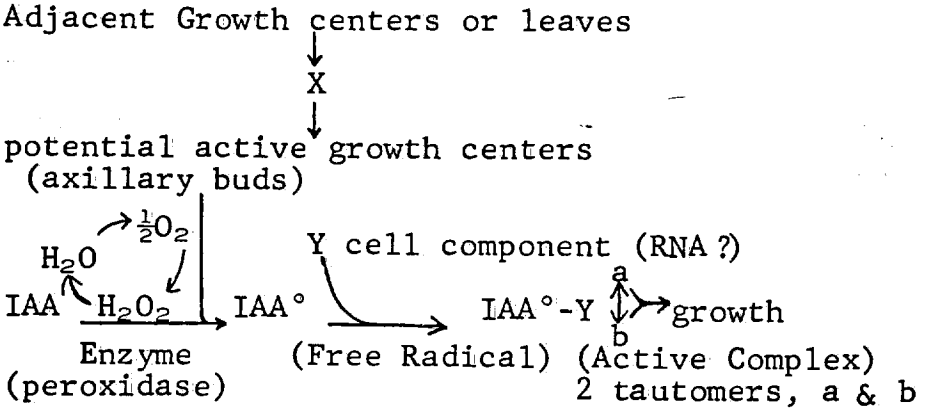
X = inhibitor or activator of the enzyme

Y = cell component (RNA ?)

From the above postulate that IAA needs to be enzymatically transformed in order to be physiologically active, it is conceivable that by controlling any one of the steps leading to the formation of the active complex, one also controls the growth of suckers. Using a model system, Horseradish-peroxidase and cofactors, we found that various compounds known to inhibit growth also inhibited the oxidation of IAA. Several of these compounds such as 6-Aza-Uracil, Iodoacetate, and MH-30 will be discussed.

REVIEW BY R. A. LUTZ

This study shows that there is an irreversible increase in cell-elongation, or growth in plants, due to the enzymatic oxidation of Indole-3-Acetic Acid (IAA) by peroxidase. This new concept is an essential step in cell-elongation, and experimental evidence presented leads to the following formulation of the process of IAA transformation as it may occur in plants:



The H_2O_2 generating system includes dichlorophenone and $MnCl_2$. This concept indicates that Indole-3-Acetic Acid (IAA) has to be oxidized to the active form in order to promote elongation. Phenols interfere with the H_2O_2 generating system and block the enzymatic oxidation of IAA.

From the above postulate that Indole-3-Acetic Acid (IAA) needs to be enzymatically transformed in order to be physiologically active, the author conceived that by controlling any one of the steps leading to the formation of the active complex, one also controls the growth of suckers.

To study this reaction, the author used a model system, Horseradish-peroxidase and cofactors. The active complex was separated by electrophoresis. Three compounds were isolated and found to be biologically active by a straight growth test.

The author noted that leaf growth was in relation to the activity of the dichlorophenone-$MnCl_2$ enzyme system and that two fractions contained peroxidase activity. One fraction was more dependent on H_2O_2 and pH 6.1, the other more dependent on pH 6.8.

The effects of compounds on Indole-3-Acetic Acid activity and on cell growth were studied. There was a correlation between inhibition of growth and enzymatic activity. Monophenols such as hydroquinone, pyro-catechol, and 6-Aza-Uracil showed good control of sucker growth, while MH-30 (Maleic Hydrazide) had no effect.

The author concluded that various compounds known to inhibit growth also inhibit the oxidation of Indole-3-Acetic Acid.